

AMENDMENTS TO THE CLAIMS

The listing of claims below replaces all prior versions of claims in the application.

1. (Currently Amended) A process for forming a resist pattern, comprising:

forming a resist pattern to be thickened on an underlying object;

applying a surfactant composition containing at least a first surfactant on the resist pattern to be thickened; and

applying a resist pattern thickening material comprising at least a resin and a second surfactant on the resist pattern to be thickened;
wherein the first surfactant contained in the surfactant composition is a metal-free surfactant; and

wherein the metal-free surfactant is a nonionic surfactant; and

wherein the nonionic surfactant is at least one selected from the group consisting of polyoxyethylene-polyoxypropylene condensates, polyoxyalkylene ethers, polyoxyethylene alkyl ethers, polyoxyethylene derivatives, sorbitan fatty acid esters, glycerol fatty acid esters, primary alcohol ethoxylates, phenol ethoxylates, alkoxylates, fatty acid esters, amides, and ethylene diamines;

and wherein the polyoxyethylene-polyoxypropylene condensates, the polyoxyalkylene ether, the polyoxyethylene alkyl ether and the polyoxyethylene derivatives are primary alcohol-based compounds.

2. (Original) A process for forming a resist pattern according to Claim 1, further comprising heating the resist pattern to be thickened after applying the surfactant composition and before applying the resist pattern thickening material.

3. (Original) A process for forming a resist pattern according to Claim 2, wherein the resist pattern to be thickened is heated at 70°C to 150°C.

4. (Original) A process for forming a resist pattern according to Claim 1, wherein the surfactant composition further comprises a solvent in which the resist pattern to be thickened does not dissolve.

5. (Original) A process for forming a resist pattern according to Claim 4, wherein the solvent is water.

6. (Canceled)

7. (Original) A process for forming a resist pattern according to Claim 1, wherein the second surfactant contained in the resist pattern thickening material is a metal-free surfactant.

8-9. (Canceled)

10. (Original) A process for forming a resist pattern according to Claim 1, wherein the resist pattern thickening material is soluble in at least one of water and alkalis.

11. (Original) A process for forming a resist pattern according to Claim 1, wherein the resist pattern thickening material further comprises a crosslinking agent.

12. (Original) A process for forming a resist pattern according to Claim 11, wherein the crosslinking agent is at least one selected from the group consisting of melamine derivatives, urea derivatives, and uril derivatives.

13. (Original) A process for forming a resist pattern according to Claim 1, wherein the resin contained in the resist pattern thickening material is at least one selected from the group consisting of poly(vinyl alcohol)s, poly(vinyl acetal)s, poly(vinyl acetate)s, poly(acrylic acid)s, and polyvinylpyrrolidinones.

14. (Original) A process for forming a resist pattern according to Claim 1, wherein the resist pattern thickening material further comprises an organic solvent.

15. (Original) A process for forming a resist pattern according to Claim 14, wherein the organic solvent is at least one selected from the group consisting of alcohol solvents, chain ester solvents, cyclic ester solvents, ketone solvents, chain ether solvents, and cyclic ether solvents.

16. (Original) A process for forming a resist pattern according to Claim 1, further comprising developing the resist pattern thickening material after applying the resist pattern thickening material.

17. (Original) A process for forming a resist pattern according to Claim 16, wherein pure water is used for developing the resist pattern thickening material.

18. (Original) A process for forming a resist pattern according to Claim 1, wherein the resist pattern to be thickened is formed with an ArF resist.

19. (Original) A process for forming a resist pattern according to Claim 18, wherein the ArF resist is at least one selected from the group consisting of acrylic resists having an alicyclic functional group in its side chain, cycloolefin-maleic anhydride resists, and cycloolefin resists.

20. (Currently Amended) A process for fabricating a semiconductor device, comprising:
forming a resist pattern to be thickened on an underlying object;
applying a surfactant composition containing at least a first surfactant on the resist pattern to be thickened;
applying a resist pattern thickening material comprising at least a resin and a second surfactant on the resist pattern to be thickened so as to form a thickened resist pattern; and

patterning the underlying object by performing an etching using the thickened resist pattern as a mask;

wherein the first surfactant contained in the surfactant composition is a metal-free surfactant;

wherein the metal-free surfactant is a nonionic surfactant;

and wherein the nonionic surfactant is at least one selected from the group consisting of polyoxyethylene-polyoxypropylene condensates, polyoxyalkylene ethers, polyoxyethylene alkyl ethers, polyoxyethylene derivatives, sorbitan fatty acid esters, glycerol fatty acid esters, primary alcohol ethoxylates, phenol ethoxylates, alkoxylates, fatty acid esters, amides, and ethylene diamines;

the polyoxyethylene-polyoxypropylene condensates, the polyoxyalkylene ether, the polyoxyethylene alkyl ether and the polyoxyethylene derivatives are primary alcohol-based compounds.

21. (Withdrawn) A semiconductor device, comprising a pattern, wherein the semiconductor is formed by a process comprising:

forming a resist pattern to be thickened on an underlying object;

applying a surfactant composition containing at least a first surfactant on the resist pattern to be thickened;

applying a resist pattern thickening material comprising at least a resin and a second surfactant on the resist pattern to be thickened so as to form a thickened resist pattern; and

patterning the underlying object by performing an etching using the thickened resist pattern as a mask.

22. (Currently Amended) A process for forming a resist pattern, comprising:

forming a resist pattern to be thickened on an underlying object;

applying a surfactant composition containing at least a first surfactant on the resist pattern to be thickened;

applying a resist pattern thickening material comprising at least a resin and a second surfactant on the resist pattern to be thickened; and

prebaking the resist pattern applied with the resist pattern thickening material;

wherein the first surfactant contained in the surfactant composition is a metal-free surfactant;

wherein the metal-free surfactant is a nonionic surfactant; and

wherein the nonionic surfactant is at least one selected from the group consisting of polyoxyethylene-polyoxypropylene condensates, polyoxyalkylene ethers, polyoxyethylene alkyl ethers, polyoxyethylene derivatives, sorbitan fatty acid esters, glycerol fatty acid esters, primary alcohol ethoxylates, phenol ethoxylates, alkoxylates, fatty acid esters, amides, and ethylene diamines;

and wherein the polyoxyethylene-polyoxypropylene condensates, the polyoxyalkylene ether, the polyoxyethylene alkyl ether and the polyoxyethylene derivatives are primary alcohol-based compounds.